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SECTORAL POLICY QUESTIONS: FOOD AND SUSTAINABLE AGRICULTURAL DEVELOPMENT

The use of freshwater resources for food and agricultural production, as well as the implications of the results of the Uruguay Round of multilateral trade negotiations for food production, including agro-industrial products and on global food security in developing countries

Report of the Secretary-General

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I. INTRODUCTION

1. In its resolution 49/103, the General Assembly urged the international community to place food and agricultural development high on the development agenda and to mobilize resources at the national, bilateral and multilateral levels in support of sustainable productive agriculture and food security in developing countries. It recognized that freshwater resources are an increasingly scarce commodity in a growing number of countries, and that there is a need to increase food production in developing countries, in part through improved irrigation and water resource management. The Assembly also noted that the agreements reached in the Uruguay Round of multilateral trade negotiations have established a basis for the reform of trade in agriculture, and will have an important impact on the development of food production, agro-industrial products, and international markets for agricultural and tropical products, as well as on global food security. The Assembly requested relevant organizations and bodies of the United Nations system and the multilateral financial institutions to strengthen their efforts to assist interested developing countries in the formulation and implementation of national water policies and strategies, and called upon the international community to give special attention to the revitalization of economic growth and sustainable development in developing countries, through, inter alia, a more diversified food and agriculture sector. Finally, the Assembly requested the Secretary General, in consultation with the relevant organs, organizations and bodies of the United Nations system, to submit a report on the implementation of the resolution, focusing in particular on the use of freshwater resources, as well as on the effects of the results of the Uruguay Round on food production, including agro-industrial products and global food security in developing countries.

2. The present report has been prepared in response to that request and has benefited, in particular, from contributions by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Development Programme (UNDP). Section II covers issues concerning the use of freshwater resources in relation to food and agricultural development and the activities of organizations of the United Nations system in that area. Section III deals with the possible effects of the Uruguay Round Agreement on Agriculture on food production, including agro-industrial products and global food security in developing countries.

II. FRESHWATER RESOURCES AND AGRICULTURAL PRODUCTION

A. Introduction

3. The stock of global freshwater supplies comprises basically two forms: surface water and groundwater. Surface water consists of the freshwater in rivers, lakes and reservoirs that collects and flows on the earth's surface. Groundwater, by contrast, collects in porous layers of underground rock known as aquifers. Though some groundwater is renewed by the percolation of rain or melted snow, most has been accumulated over geologic time and, because of its location, cannot be recharged once it is depleted (Tielenberg, 1992).

4. Globally, the available supply of freshwater (total run-off) exceeds current demand by about 10 times. That aggregate statistic, however, masks significant differences in the distribution of and demand for freshwater worldwide. The impact of growing demand in relation to supply in certain parts of the world is already resulting in severe excess demand situations in such regions. An Urbanizing World: Global Report on Human Settlements, 1996 1/ estimates that by the year 2000, worldwide available freshwater supplies will be equivalent to only 3.5 times demand because of world population growth.

5. The present section briefly reviews some salient issues related to freshwater resources, agricultural production and food security. It also provides a brief overview of the activities of agencies of the United Nations system and other organizations on water resources management.

B. Availability and regional distribution of freshwater 2/

6. If global run-off were divided evenly across continents, it could provide each person with 7,690 cubic metres (m^3) a year of freshwater (1990 population). In reality, however, some continents are rainier than others, and there are important variations within continents (see table 1). Per capita water utilization varies widely between continents, from 1,692 m^3 per year in North America to 244 m^3 per year in Africa.

7. Worldwide, almost 70 per cent of water consumption is used in agriculture (see table 2). However, the share of agriculture is constantly declining due to rising demands from other sectors. The pattern of water use reflects the process of economic development: as wealth increases, water withdrawal shifts from agriculture to industry and the household sector.

8. In many irrigation systems, water is lost at every stage between the source and the crop. Average losses in irrigation projects suggest that only about 45 per cent of water diverted or extracted for irrigation actually reaches the crop, but losses vary widely between 5 and 50 per cent. Sources of loss are field application losses (25 per cent), farm distribution losses (15 per cent) and irrigation system losses (15 per cent) (FAO, 1994).

9. Most of the water runs off or evaporates before it even reaches the plants. The above-mentioned figures characterize agriculture as a low-efficiency water user. In many countries, although scarcity is less of a problem at the national level, overuse of groundwater, contributing to waterlogging and salinity, has become a major problem in specific regions, such as northern China, western and southern India and parts of Mexico.

Table 1. Annual freshwater supply and withdrawal, by continents and selected countries, 1990

Continents/countries	Water supply			Water withdrawal		
	Total (km^3)	Per km^2 (m^3)	Per capita (m^3)	Total (km^3)	Per capita (m^3)	Per capita use/supply ratio (percentage)
World	40 673	309 799	7 690	3 240	660	9
Africa	4 184	141 154	6 460	144	244	4
Kenya	15	26 330	590	1.1	48	8
Zaire	1 019	449 374	28 310	0.7	22	>0
North America	6 945	324 882	16 260	697	1 692	10
Mexico	357	187 039	4 030	54	901	22
Canada	2 901	314 609	109 370	42	1 752	2
South America	10 377	591 982	34 960	133	476	1
Peru	40	31 250	1 790	6.1	294	16
Brazil	5 190	613 728	34 520	35	212	1
Asia	10 485	383 893	3 370	1 531	526	16
China	2 800	300 223	2 470	460	462	19
Indonesia	2 530	1 396 579	14 020	17	96	1
Europe	2 321	490 746	4 660	359	726	16
Poland	49	160 946	1 290	17	472	37
Sweden	176	427 579	21 110	4.0	479	2
Oceania	2 011	238 639	75 960	23	907	1
Australia	343	45 025	20 480	18	1 306	6
Papua New Guinea	801	1 768 759	199 700	0.1	25	>0

Source: Data drawn from World Resources Institute (in collaboration with the United Nations Environment Programme and the United Nations Development Programme, World Resources 1992-1993 (Oxford University Press, 1993).

Table 2. Uses of freshwater, by continents and selected countries, 1990

(Percentages)

Continents/countries	Domestic	Industry/power	Agriculture
World	8	23	69
Africa	7	5	88
Kenya	27	11	62
Zaire	58	25	17
North America	9	42	49
Mexico	6	8	86
Canada	11	80	8
South America	18	23	59
Peru	19	9	72
Brazil	43	17	40
Asia	6	8	86
China	6	7	87
Indonesia	13	11	76
Europe	13	54	33
Poland	16	60	24
Sweden	36	55	9
Oceania	64	2	34
Australia	65	2	33
Papua New Guinea	29	22	49

Source: Same as table 1.

C. Water resource development and food security

1. World Food Summit

10. At its twenty-eighth session, in October 1995, the FAO Conference called for the convening of a World Food Summit at the level of heads of State or Government in Rome in November 1996; the holding of the Summit was also unanimously endorsed by the General Assembly. The objective of the Summit is to renew the commitment of world leaders to the eradication of hunger and malnutrition and the achievement of lasting food security for all.

11. The Summit is intended to address the need for global action to redress human society's most basic problem: food insecurity. It is expected to lead to the adoption of appropriate policies and strategies at international and national levels, as well as a plan of action for implementation by all parties concerned: Governments, international institutions and all sectors of civil society. Water management is one of the important issues to be discussed at the Summit. 3/

2. Problem areas with respect to food security

12. When annual internal renewable water resources are less than 1,000 m^3 per caput, water availability is considered a severe constraint on socio-economic development and environmental protection. More than 230 million people living in some 26 countries - 11 in Africa and 9 in the Near East - already fall into that category. Table 3 lists the countries in which per caput internal renewable water availability will fall below 1,000 m^3 by the year 2000.

Table 3. Countries predicted to have scarce water resources in 2000

Country a/	Population in 2000 (millions)	Water availability	
		Internal renewable water resources (m^3 per caput)	Water resources, including river flows from other countries (m^3 per caput)
Egypt	62.4	29	934
Saudi Arabia	21.3	103	103
Yemen	16.2	155	155
Syrian Arab Republic	17.7	430	2 008
Kenya	34.0	436	436
Algeria	33.1	570	576
Hungary	10.1	591	11 326
Rwanda	10.4	604	604
Malawi	11.8	760	760
Sudan	33.1	905	3 923
Morocco	31.8	943	943
Somalia	10.6	1 086	1 086

Source: FAO, "Water policies and agriculture", in The State of Food and Agriculture 1993 (Rome, 1993).

a/ Countries with smaller populations also included in the water-scarce category: Libyan Arab Jamahiriya, United Arab Emirates, Jordan, Mauritania, Israel, Tunisia, Burundi, Botswana, Oman, Barbados, Cape Verde, Djibouti, Malta, Qatar and Singapore.

Countries with less than 2,000 m^3 per caput face a serious marginal water scarcity situation, with major problems occurring in drought years. By the end of the 1990s, water availability is expected to fall below 2,000 m^3 per caput in more than 40 countries. The continents of Africa and Asia, in particular, are showing signs of a decline in freshwater availability, and water quality is also declining. In contrast, South America is well endowed.

13. Irrigated agriculture, which is much more productive than rain-fed agriculture, contributes nearly 40 per cent of world food production on 17 per cent of the world's cultivated land. The intensive agronomic technology that has allowed steady increases in world food production, based on high-yielding varieties coupled with the application of fertilizers and effective means of pest control, is largely dependent on irrigation to secure and control soil moisture in the face of insufficient and unreliable rainfall. But irrigated agriculture is a highly water-intensive activity. It claims nearly 70 per cent of world water abstraction - over 90 per cent in agricultural economies in the arid and semi-arid tropics but less than 40 per cent in industrial economies in the humid temperate regions.

14. As food needs increase, however, it is becoming increasingly difficult to supply more water to farmers. If industrial and municipal use, water losses and in-stream flow requirements are also taken into account, overall water requirements by 2025 appear to overcommit all accessible run-off by some 5 per cent. The figures underlying that analysis (respective contribution of irrigation and rain-fed agriculture, amount of water required to produce human diet and in-stream flow requirements) may be subject to different interpretation. However, it is clear that human demands will soon clash with the ability of the hydrological cycle to supply water. Water is becoming globally scarce, and that fundamental resource constraint will have an effect on the cost of food.

15. A worldwide overview of water supply and projected demand reveals the specific concerns of individual regions. Virtually all countries with mainly arid territory, such as countries in the Near East and North Africa, are already net food importers. The priority in water use in those countries will be to secure adequate water for cities and a healthy economy in the industry and service sectors in order to earn the income required for food imports. Because of the scarcity value of water, such regions will not be able to harbour water-intensive industries. The agriculture sector in water-scarce arid countries is bound to rely increasingly on wastewater freed by cities and to specialize in producing the crops yielding highest revenue and unsuitable for transportation. Food security in such countries will be closely tied to the solidity of their trading position.

16. In Asia, the amount of freshwater currently available per person and per year (3,300 m^3) is quite close to the amount of water needed to produce the food requirements per person per year (2,000 m^3 for a balanced diet with some meat). As population and the diversity of the Asian diet increases and the scope for irrigation expansion and water development narrows, intersectoral competition increases. Since 60 per cent of the world population live in Asia, that trend has the potential to severely stress global food markets. The economic strength of a number of countries in Asia is widely recognized, but it

should not be overlooked that there remain large pockets of poverty, in particular in South Asia.

17. Africa, with the exception of the central Congo-Zaire basin, is the driest continent besides Australia, and it suffers from the most unstable rainfall regime. Each year, more people are at risk from the effects of inevitable droughts of greater or lesser severity. Moreover, Africa's water resources are relatively less developed than those of other regions. Agricultural productivity per caput in sub-Saharan Africa has not kept pace with population increase and the region is now in a worse position nutritionally than it was 30 years ago: food production has achieved a growth of about 2.5 per cent per year, while population has risen at the rate of 3 per cent per year. Moreover, Africa's ability to earn from exports in order to buy food has not improved. In the past, additional food in Africa continued to come from increasing the area cultivated, but now good land is becoming scarce and the region will be forced to intensify production systems to increase yields. Water development, in its various forms from water harvesting to modern piped irrigation, is destined to make a major contribution to transforming the efficiency and security of the African food supply.

18. As a continent, Latin America is well endowed with water, although there are substantial interregional differences. Water problems in Latin America are mainly related to low water-use efficiency, resource management, environmental degradation and pollution control.

19. Increased production to satisfy the food demand of the future must essentially come from intensification, not from expansion of agriculture. Both rain-fed and irrigated agriculture will have to intensify, but the intensification potential of irrigated agriculture is much higher.

3. Potential for irrigation

20. Available estimates suggest that the potential for irrigation expansion is considerable. In 1990, a World Bank/UNDP study indicated that there is scope for an increase of over 110 million hectares (ha) (59 per cent) in the irrigated area in the developing countries. The largest potential for increase is in Asia (69 million ha, or 44 per cent), followed by South America (20 million ha, or 217 per cent, mainly in Brazil). The largest potential in relation to current levels is in sub-Saharan Africa (from 3.4 million to 16.5 million ha, or 470 per cent, mainly in Angola), which represents a response to increased technical and economic opportunity and population pressure. Some countries in sub-Saharan Africa, such as Botswana, Burkina Faso, Kenya, Mali, Mauritania, the Niger, Senegal and Somalia, already have population densities and food requirements that exceed the capacity of low-input rain-fed farming, and they also have very little land with growing periods greater than 180 days. For those countries, irrigation is likely to be an indispensable part of the overall strategy for increasing food production.

21. The benefits of exploiting such irrigation potentials are considerable. According to the World Bank/UNDP study, exploiting the developing countries' 110 million ha total potential could theoretically produce an additional

300-400 million tons of grain - enough to provide the basic diet for one and a half to two billion people. However, investments of half a billion to one billion dollars would be required (FAO, 1995), although progress in engineering, such as drilling techniques, the use of cheap and light plastic, and advances in management of construction, should lower the capital costs of water development.

4. Requirements and prospects for expanding sustainable irrigation

22. During the past four decades, the development of irrigated agriculture has provided a major part of the increase in production necessary to meet population demands. By the mid-1980s, 36 per cent of total crop production came from less than 15 per cent of the arable land that was irrigated. On a global basis, the average rate of expansion of irrigated land was about 1 per cent per year in the early 1960s and reached a maximum of 2.3 per cent per year from 1972 to 1975. The rate of expansion began to decrease in the mid-1970s and is now less than 1 per cent per year (see figures I and II). A common cause of the decrease was the high cost of irrigation development. Construction costs have risen steadily and the world price for major cereals has fallen sharply. For example, the price for rice fell by about 40 per cent in real terms between 1965 and 1985.

23. Currently, the overall performance of many irrigation projects is much less than expected. Inadequate operation and maintenance, and inefficient management of an increasingly scarce water resource contribute to many socio-economic and environmental problems. Of major concern is the rapid rise in groundwater, leading to waterlogging, depressed crop yields and soil salinity.

24. Sustained production on both irrigated and rain-fed lands requires optimal use of the physical environment in each soil-crop-climate ecosystem. In rain-fed areas, water conservation measures, such as fallow management (including crop residue management), control of run-off and water harvesting, are of primary importance. Complementary practices are the selective development of high-yielding, drought-tolerant varieties; the efficient use of herbicides and fertilizers; crop rotation; and the use of optimal planting dates to maximize the probability of rainfall during critical periods of crop growth. The synergistic effects of such practices are complex when integrated into rain-fed farming systems but are even more pronounced under irrigated agriculture, when additional effects may arise due to continuous mono-cropping. In rice production areas, for example, drainage may be required to remove toxic substances that accumulate in the soil after several consecutive crops of rice.

Figure I. Area of irrigated land, by region

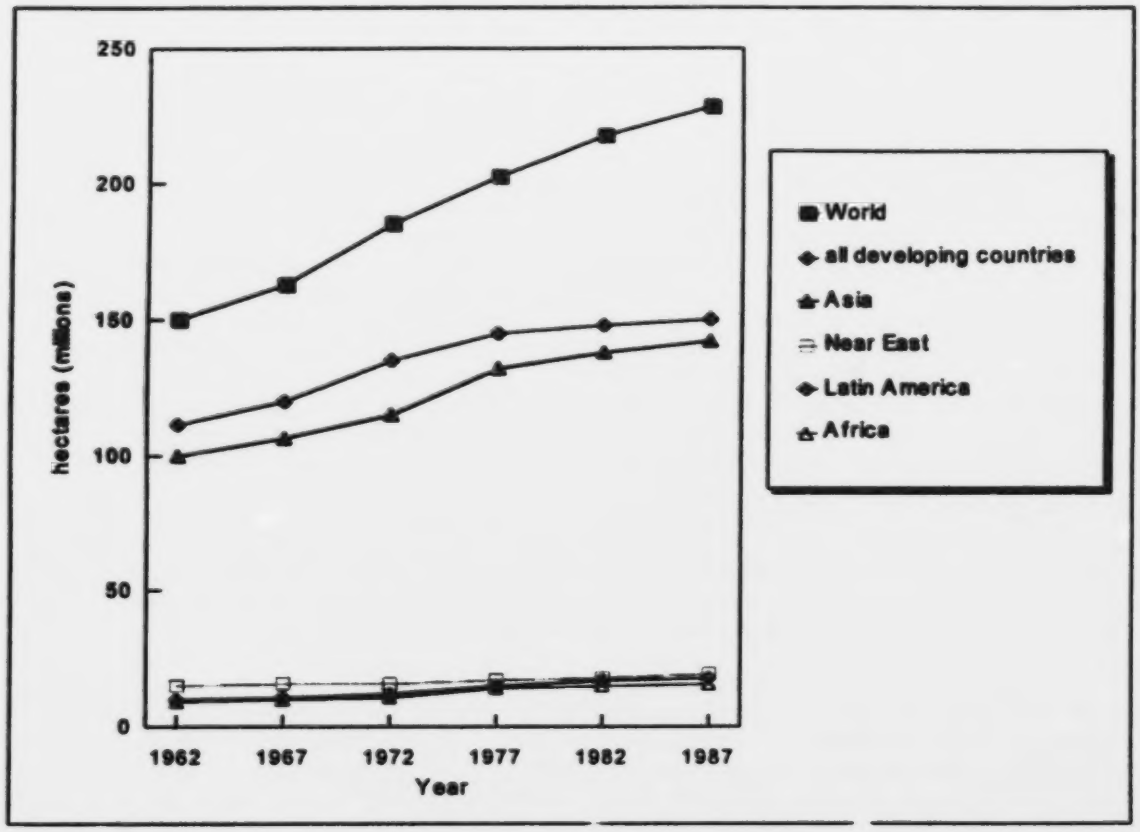
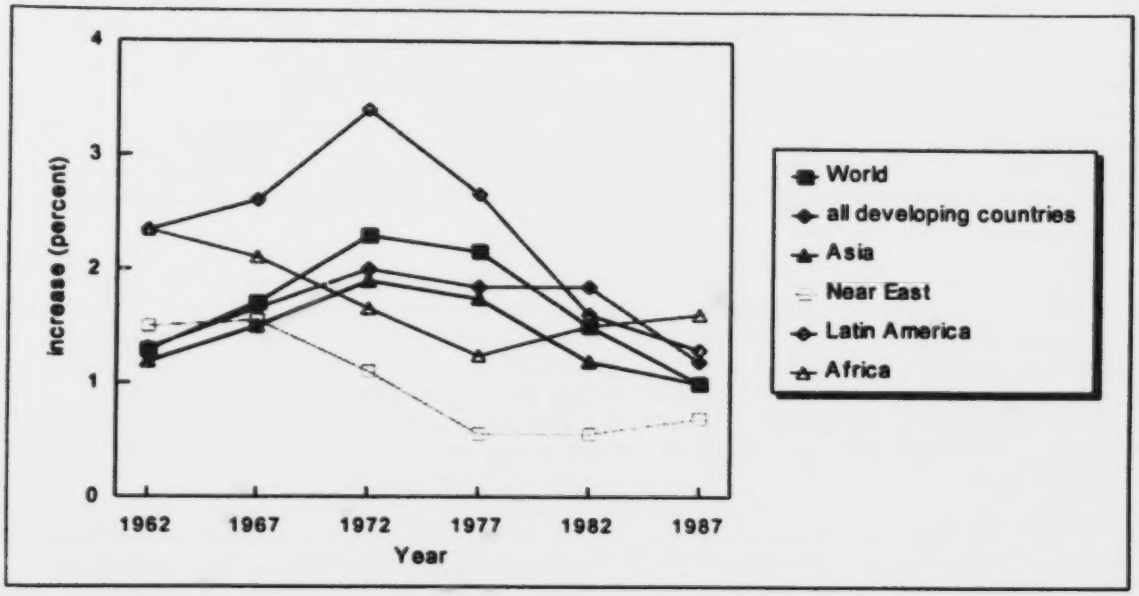


Figure II. Rate of increase in irrigated land, by region



D. Water policies and strategies in developing countries

25. A growing need for effective and timely measures to address urgent water problems that are often directly or indirectly related to agricultural water uses, such as water scarcity and environmental degradation, has increased the demands for improved decision-making, clear water policies, and adequate legal and institutional frameworks at the national level. Many countries, however, even though they face growing water problems, are not giving sufficient attention to or do not have the necessary capacity to take management measures and develop national water sector policies and the institutions to implement them.

26. Individual countries - faced with different climates, levels of water availability, economic structures, population pressures, and cultural, political and administrative systems - need to establish politically acceptable water policies to address country-specific priority issues. With a significant portion of the world's water resources being shared between two or more countries, clear and harmonized national water policies also form an important base for intercountry dialogues on cooperation and development of transboundary waters.

27. The implementation of national water sector policy requires a comprehensive approach based on an agreed and well established methodology. FAO, together with UNDP and the World Bank and in collaboration with national Governments, has developed a methodology and published guides and frameworks on approaches, processes and practices for water sector policy review at the national level. The purpose of the guides is to stimulate countries to undertake national water sector reviews; elucidate the wide range of water management measures available and their ramifications, including the relationship between the water sector and other parts of the economy; and promote national policy and legislative reform, planning and institutional development in national water sectors. Thus, the guidelines support and provide a specific methodology for the implementation of generally accepted concepts for water policy, as provided for under Agenda 21 4/ and the Dublin Statement (A/CONF.151/PC/112, annex II), and enunciated in the World Bank policy paper Water Resources Management. 5/

28. An increasing number of developing countries have initiated the process of review and reform of water-sector policies. In addition, support and technical assistance to national water-sector policy reform has increasingly been adopted by donors as priority areas.

29. National water-sector policy reviews, as part of a nation's policy-making, involve sensitive issues. It is important that policy measures be carefully selected to adapt to country-specific situations, and that the process involve and secure the commitment of national decision makers. It is in general not effective to introduce individual policy elements, such as legislation or water pricing, but to adopt a comprehensive approach with a balanced mix of policy measures in different fields, including water management, macro- and sectoral policy, and legal and institutional frameworks.

Improvement of existing water management

30. Improvement of existing water management projects will be the challenge facing irrigated agriculture in the future. Irrigation efficiency is influenced by many factors (technical, social, economic, institutional and others), and no isolated approach is likely to succeed in solving problems if they are not treated in an integrated manner. On the other hand, financial and human resources restrictions impose the need to concentrate actions in order to ensure a sizeable and durable impact.

31. In response to severe water shortages, for example, Mexico introduced a series of reforms intended to cut per caput water use. Educating people about how to save water, setting high efficiency standards for domestic appliances and charging realistic water rates were the main mechanisms involved, and were mirrored by federal legislation that established water as an economic commodity rather than a free good. The irrigation network was reorganized, with users being encouraged to operate, maintain and finance the large irrigation districts.

32. At the macrolevel, Governments find it increasingly hard to finance existing water policies. Therefore, many developing countries are implementing fundamental changes in macroeconomic and sectoral policies. Typical adjustment programmes call for a greater reliance on markets, more open trade, fiscal austerity, and a phasing out of producer and consumer subsidies (input and product markets). Budget-reducing measures imply increased competition between and within sectors for funding new water projects. The direct implications for water managers include fewer capital investments in new water projects; the elimination of irrigation subsidies; increased efforts to recover cost; and more emphasis on demand management to improve the efficiency of existing supplies.

33. FAO has established a major programme, entitled "Water-use efficiency", aimed at responding to the needs of member nations. The programme focuses on the following four areas, in which FAO has a comparative advantage arising from previous experience and accumulated expertise:

(a) Improvement of on-farm water management;

(b) Improvement of irrigation scheme management;

(c) Assessment and dissemination of intermediate water development techniques;

(d) Support to member nations.

E. Technical progress in water resource management

1. Modern irrigation designs, methods and techniques

34. Wastage in many irrigation systems can be reduced by improving technology and water management practices. Many existing irrigation systems were designed 50 to 80 years ago and are still using the same technology. Four directions of

irrigation systems improvement have the greatest potential for convenient services and environmentally and economically sustainable operation (FAO, 1995 (b)):

(a) Structural improvements of main systems through the use of new equipment and material (low-pressure pipes, geo-textiles etc.);

(b) Modern water control technology (local and central control of flow and water levels, decision support systems);

(c) Integrated water-use systems (conjunctive use, artificial recharge);

(d) Decentralized schemes with optimized distribution and application systems (low-lift pump schemes, small-scale irrigation).

35. What is generally needed is education and training of extension staff and farm managers to transfer experience and technology among scientists, technicians and farmers; monitoring and evaluation of irrigation project performance and groundwater; long-term strategies and planning for the management of scarce water resources; and refinement in short-term policies.

2. Small-scale water programmes

36. During recent decades, large irrigation projects have been given a high priority, while small-scale water programmes for agriculture, such as water harvesting and small-scale irrigation, have received inadequate attention. However, small-scale water programmes have considerable potential to meet agricultural and domestic water needs and to enhance land and water conservation. They can fulfil many local water needs within the context of sustainable agricultural development. The goals of such programmes include the development of small-scale irrigation; the provision of a water supply for humans and livestock; improved infiltration to groundwater; soil conservation; and flood spreading and flood control.

37. In most parts of the world, women are the main producers in rain-fed agriculture. The techniques mentioned above have particular implications for them. They may require women to take on roles traditionally reserved for men, and may also involve additional time, financial resources, technical and literacy skills and organizational capacities. Women need to be involved in such activities and to have access to inputs, otherwise the technical solutions to the water problem may not prove viable.

3. Water harvesting

38. Because large capital investments are not necessary, water-harvesting is an important element of small-scale water programmes. Water-harvesting involves catching water over a large area without crops and spreading it over the land to be cropped. In very dry areas, such as the Negev desert, the catchment area can be very large: sometimes 250 ha of catchment are used to provide water for just one hectare of crops. Variations on that theme have been used to increase the

productivity of rain-fed crops on every continent. Water-harvesting techniques range from placing lines of stones along the contour lines on fields to hold back run-off to much more sophisticated and expensive techniques. Water-harvesting techniques have two advantages to the farmer: they increase agricultural productivity and reduce soil erosion (which is caused mainly by unchecked run-off). The potential for water harvesting is particularly great in Africa, where relatively little land is irrigated and production depends primarily on rain-fed agriculture. It has been estimated that in the semi-arid and dry subhumid areas of Africa, water harvesting could increase production on 10 million ha in the short term and on 50 million ha in the long term.

4. Modern small-scale irrigation

39. The advent of cheap, dependable motors and pumps and the increasing availability of fuel or electric power has revolutionized irrigation. Small pump schemes, individual or communal, have begun to play a very important role in augmenting food production. They are widely used as a means to supplement irregular canal water supply, in particular in the river deltas of Asia but increasingly also in Africa. Pump schemes are easy to install and operate. Experience has shown that pump schemes for a small number of farmers with small landholdings are more productive in terms of yield per ha and more efficient in terms of water use than are large gravity schemes. In addition, exposure to water-borne diseases, such as bilharzia, is reduced if water is distributed through pipes.

5. Improving access to water resources: utilization of shallow aquifers

40. The term "shallow aquifer" refers to groundwater bodies in which water is accessible using indigenous methods of well construction and low-cost techniques, such as wash-bores, hand drilled wells and well points. Water for irrigation is abstracted through centrifugal pumps located at ground level or in a nearby pit, so that the pump is not more than 5 metres above the water level. The advantages of shallow aquifers for small-scale irrigation are numerous:

(a) Easy access to the resource, thanks to low capital costs that facilitate private investment by individuals or small groups of farmers;

(b) No need to convey water over long distances;

(c) Full reliance on nature to renew, store and convey water, with only limited intervention;

(d) Widespread availability, even in semi-arid areas, mostly in the alluvial deposits of valleys but also in fractured rocks. Annual rain and floods contribute to the recharge of the aquifer, which may often be increased artificially by creating small structures allowing water to infiltrate.

41. Information on the extent and yield of shallow aquifers is insufficient. A difficult problem is the management of shallow aquifers to avoid overdraft and equal access.

F. Mitigating environmental effects

42. Much agricultural land is deteriorating due to inappropriate soil and water management. Soil erosion, nutrient depletion, salinization and waterlogging all reduce productivity and jeopardize long-term sustainability. Fortunately, understanding of the causes of those negative effects has greatly increased, and in almost all circumstances corrective measures are possible.

1. Water-related vector-borne diseases

43. Water-related vector-borne diseases are most likely to be found in areas in which irrigation has been introduced. Among them, malaria is by far the most important, both in terms of the number of people annually infected and whose quality of life and working capacity are reduced, and in terms of mortality.

44. The risk that bilharzia or malaria is introduced or has an increased impact is most likely in irrigation schemes in which (FAO, 1995):

(a) Soil drainage is poor;

(b) Rice or sugar cane is cultivated;

(c) Night storage reservoirs are constructed;

(d) Borrow pits are left with stagnant water;

(e) Canals are unlined and have unchecked vegetation growth.

45. Implementation of such measures of environmental management for vector control have been successful in a number of projects in Japan, China and Zimbabwe (FAO, 1995 (a)). In China, the introduction of intermittent irrigation in rice cultivation - as opposed to continuous flooding - reduced the larval mosquito population by 85 per cent, decreased irrigation water demand by 50 per cent and increased yield by 12 per cent.

2. Waterlogging and salinization

46. The United Nations Environment Programme (UNEP) reports that the rate of loss of irrigated land from waterlogging and salinity is 1.5 million ha per year. Millions of hectares of irrigated land suffer from such progressive conditions: salinity-affected areas as a percentage of total irrigated area are estimated to stand at 10 per cent in Mexico, 11 per cent in India, 21 per cent in Pakistan, 23 per cent in China and 28 per cent in the United States of America.

47. Salinity is caused by a combination of poor drainage and high evaporation rates that concentrate salts on irrigated land; it mainly occurs in arid and semi-arid regions. Even good-quality irrigation water contains some dissolved salt and can leave behind tons of salt per hectare each year. Unless that salt is washed down below the root level, soil salinity will result.

48. A related concern is the rapid rise in groundwater levels, leading to waterlogging and depressed crop yields. Waterlogging occurs when excessive water is used in systems with finite natural drainage capacities. Seepage occurs if soils are very light; canals and watercourses are not lined or maintained; farmers near the head of a system withdraw or apply excessive amounts of water; fields are not levelled; and/or the delivery system cannot respond to rainfall by closing inflows. If seepage and horizontal recharge exceed evaporation and natural drainage, then groundwater levels rise, eventually causing waterlogging. If upward movement of water and evaporation exceed downward percolation in areas in which the groundwater, soil or irrigation water contains some salt, the build-up of salt in the soil surface layers will eventually reach toxic levels.

G. Conclusion

49. Population growth, migration and urbanization will continue to have a significant impact on all aspects of development, including the demand for food. Water policies that led to past misallocations and wastage need to be continually reviewed and their implementation supported by an enabling environment, with adequate and properly enforced law. The importance of including the intended beneficiaries in the design and implementation of new projects is now recognized, as is the need for realistic, uncomplicated project designs. The institutional capacity of Governments, non-governmental organizations and the private sector to work together is rapidly improving. A wide array of water development technologies is currently available, but private and public investment funds are needed for their implementation. The major challenge, however, is building capacity at all levels to achieve the efficient, highly productive management of water needed to secure sustainable, sufficient and low-priced food for the projected population.

50. The importance of conservation, sustainable use and integrated management of water resources needs no emphasis in the light of increasing competition for a finite and limited supply of freshwater. The Dublin Statement stressed the need for a holistic approach to the effective management of freshwater resources, including the protection of natural ecosystems. The central theme of chapter 18 of Agenda 21 is the application of integrated approaches to the conservation and sustainable use of freshwater. A number of United Nations bodies and other entities have accorded high priority, in both their regular programmes and their field projects, to the integrated management of water resources, including conservation and sustainable use, as described below.

H. Activities of United Nations bodies and other entities in the area of water resources management

1. Food and Agriculture Organization of the United Nations

51. The overall objective of the FAO International Action Programme on Water and Sustainable Agricultural Development is to assist member nations in adopting an integrated approach to water resources management in order to achieve the goals of food security, sustainable agriculture and rural development. The programme focuses on integrated rural water management, which is the management of water resources to meet the total water needs of the rural populations, including agricultural production (irrigation, livestock production and aquaculture), agro-industries, and drinking and sanitation, in an integrated manner so as to improve water-use efficiency, conserve water resources and protect water quality.

52. National action programmes on water and sustainable agricultural development have been formulated in a number of countries, such as China, Egypt, Indonesia, Mexico, Tanzania, Syria and Zimbabwe, as well as for Lake Chad. In the participating countries, such programmes have mobilized Governments to review and revise national water policies, initiate action to prepare irrigation master plans, implement pilot schemes on the reuse of waste water and undertake other similar follow-up actions.

53. FAO programmes on water conservation and water quality protection place great emphasis on food production and food security. FAO has produced guidelines and provided assistance for pilot-scale projects on water harvesting and soil moisture conservation in order to conserve rainfall and increase the soil moisture availability for crops. In the area of water quality protection, FAO has promoted the adoption of agricultural practices that would minimize non-point source pollution. Safe use of treated municipal wastewater and saline drainage waters is promoted as a means to control water pollution and augment water supplies for agriculture.

2. World Bank

54. An important United Nations system activity to promote the integrated management of water resources is the World Bank initiative to develop a comprehensive approach to water resources management. The core of the initiative is the adoption of a comprehensive policy framework and the treatment of water as an economic good, combined with decentralized management and delivery structures, greater reliance on pricing and fuller participation by stakeholders. The initiative has been adopted by the Bank as an operational directive, implying that the Bank will encourage and, when requested, selectively help countries to develop and implement national policies, strategies and programmes for managing water resources in a comprehensive manner.

55. The World Bank recently launched another initiative on integrated management of water resources in the sub-Saharan region, the key objective of which is poverty reduction through sustainable management of water resources.

Programme elements include household water security, food security and water, water quality and human health, environmental stewardship and regional cooperation.

3. United Nations Development Programme

56. UNDP has developed a sustainable agriculture networking and extension (SANE) programme. The primary goal of the SANE programme is to enhance capacity-building and human resource development in the area of sustainable agriculture through agro-ecological training, participatory research, policy advocacy and information networking among non-governmental organizations and other national/international organizations in Africa, Asia and Latin America.

57. UNDP is also in the process of developing a food security strategy for handling food security issues in its programmes. Food security is an important area of work that cuts across all aspects of sustainable human development upon which UNDP places priority (poverty alleviation, sustainable livelihoods, gender issues and environment).

58. The Office to Combat Desertification and Drought has developed a global programme to facilitate the transfer of knowledge, experience, techniques and technologies on sustainable water management in the drylands, with a focus on Africa, in partnership with the International Development Research Centre, the Centre for Development Cooperation Services of the Free University of Amsterdam, the Natural Heritage Institute (USA) and Environmental Development in the Third World (ENDA) Senegal.

59. In the area of improving the efficiency of water use for irrigation, UNDP supports the International Programme for Technology Research in Irrigation and Drainage (IPTRDI). IPTRDI was set up in 1991 to enhance irrigation and drainage technology in developing countries, in response to calls within the profession for a new initiative to enhance and expand research in developing countries. Other IPTRDI sponsors include the World Bank, the International Commission on Irrigation and Drainage (ICID), bilateral aid ministries and development foundations.

4. Department for Development Support and Management Services of the United Nations Secretariat

60. The Department for Development Support and Management Services has been designated the lead agency within the United Nations system to assist member nations in implementing the integrated water resources management component of Agenda 21. The Department is promoting the development of an interactive approach to policy formulation and resource planning, paying particular attention to the experiences gained in the various water-related projects throughout the world. That innovative approach is currently being tested through ongoing technical cooperation activities in many developing countries, such as Bolivia, the Central African Republic, India, Jordan, Morocco, Nepal, the Niger, Peru, Senegal and Yemen. By means of water sector assessments, diagnostic studies, and national and water basin programmes related to water

resources planning and management, an integrated approach is applied to water use and the equitable allocation of water among users.

5. World Health Organization and United Nations Environment Programme

61. The World Health Organization (WHO), in collaboration with UNEP, has promoted the protection of water quality in the context of human health and the conservation of aquatic ecosystems. The development and application of drinking water quality guidelines, the surveillance of drinking water quality and the eradication of water-borne diseases have been given high priority. Considerable progress has been made in the establishment of water quality monitoring programmes worldwide. International river basins, such as the Danube, the Mekong, the Parana-Plata and the Nile, are now covered by multilaterally agreed monitoring networks.

6. International Irrigation Management Institute

62. The activities of the International Irrigation Management Institute (IIMI), a Consultative Group on International Agricultural Research institution with the mandate to foster sustainable irrigated agriculture in developing countries, are relevant in the context of efforts by international organizations outside the United Nations system to promote the conservation and sustainable use of water for food production. IIMI has a strong programme on institution-building, which consists of strengthening national research capacity and human resources development for improved irrigation management.

7. International Commission on Irrigation and Drainage

63. The aim of ICID, the largest international and scientific non-governmental organization in the field of irrigation and drainage, is to stimulate and promote irrigation and development worldwide in a sustainable manner. It has established national committees in more than 80 countries, and through its regular meetings and special seminars has played a major role in the exchange of experience and technical information on the sustainable use and conservation of water in food production.

8. Inter-agency bodies

64. At the inter-agency level, there are a number of coordination mechanisms that address United Nations system activities related to freshwater resources, particularly integrated water resources management, as described below.

ACC Subcommittee on Water Resources

65. The Subcommittee has overall responsibility for the coordination of water resources activities of the United Nations system, in particular for follow-up of the Mar del Plata Action Plan and the Dublin Statements, and acts as the task

manager for chapter 18 of Agenda 21. The Subcommittee reports to the Inter-Agency Committee on Sustainable Development, which in turn reports to ACC.

Global Water Partnership

66. The Partnership focuses on coordinated and integrated approaches to sustainable water resources management, consistent with the principles of the International Conference on Water and the Environment and the United Nations Conference on Environment and Development, in the development of catalytic activities.

Informal Inter-Agency Working Group on Water of the United Nations System-wide Special Initiative for Africa

67. The Working Group, which is co-chaired by the World Bank and UNEP, was established in April 1996. It coordinates activities outlined in the water cluster of the Special Initiative. Those activities also form part of the implementation of chapter 18 of Agenda 21 (but in a specific regional setting) and of the regular and field programmes of United Nations system organizations.

Panel of Experts on Environmental Management for Vector Control

68. The Panel is a joint activity of WHO, FAO, UNEP and the United Nations Centre for Human Settlements in the area of prevention and control of water-borne and associated diseases in agricultural water development activities.

III. THE URUGUAY ROUND AGREEMENT ON AGRICULTURE AND WORLD FOOD PRODUCTION AND FOOD SECURITY

A. Introduction

69. The Final Act of the Uruguay Round of multilateral trade negotiations 6/ was signed at Marrakesh in April 1994. For the first time, Governments agreed to fundamental reform and liberalization of world trade in agricultural products. Agricultural products account for about 10 per cent of the value of world merchandise trade.

70. The present chapter focuses on the implications of the reform of world agricultural trade initiated by the Uruguay Round Agreement on Agriculture 6/ for the development of global food production, agro-industrial products and international markets for agricultural and tropical products. An important consideration is the contributions of the reforms to global food security. Also of interest is the extent to which a more open agricultural trading system will stimulate food production and productivity in developing countries, and how those countries can be assisted to transform their policies as well as provided with technical assistance.

71. After the brief overview of the main elements of the Agreement on Agriculture contained in section III B below, sections III C-F below discuss, on the basis of existing empirical studies, the likely effects of the Agreement on global production of and trade in food and agricultural products, including

agro-industrial products; global food security; and the income and food import bills of developing countries. Technical assistance needs are also identified.

B. The Agreement on Agriculture

72. An overview of the Agreement on Agriculture is presented in table 4, which identifies the provisions that apply specifically to either developed or developing countries, as well as those that apply to both. The Agreement officially entered into force in 1995. Developed countries are to complete all reduction commitments within six years, whereas developing countries have 10 years. The least developed countries are not required to make any reductions. Commodities covered are all agricultural products (except fishery and forest products), including rubber, jute, sisal, abaca and coir, which fall under normal World Trade Organization (WTO) tariff negotiations on goods. The Agreement aims to liberalize trade by improving market access, reducing domestic support and reducing export subsidies. The abolition of non-tariff barriers (through tariffication), the reductions of tariffs, subsidies and support, and the fact that nearly all tariffs will be bound represent an enormous achievement.

73. Developing countries are given special and differential treatment. Purchases and sales from food security stocks is allowed at administered prices, provided that the subsidy to producers is included in the total Aggregate Measure of Support. In addition, untargeted subsidized food distribution, investment subsidies and input subsidies are excluded from reduction commitment.

74. As to the implementation of the Agreement, aggregate domestic support will be reduced from US$ 198 billion to US$ 162 billion, and export subsidies (in value terms) will be cut from US$ 21.3 billion to US$ 13.8 billion. Most of those reductions (about 90 per cent) will take place in developed countries since they have the highest levels of support.

75. Tariffs resulting from conversion (tariffication) of non-tariff measures plus pre-existing tariffs on all agricultural products are to be reduced by 36 per cent (developed countries) and 24 per cent (developing countries). For products covered by the tariffication process, current and minimum market access opportunities are generally provided through tariff quotas. Exports up to those levels are subject to much lower tariffs, while much higher tariffs resulting from tariffication apply to above-quotas units. Because above-quota tariffs tend to be prohibitive in many cases, in such cases the real market access opportunities created may reside mainly in the lowering of within-quota tariffs.

76. There is reason to believe that Uruguay Round liberalization will have several effects, including higher prices for affected agricultural products and an associated shift in production. In addition, the reduction in export subsidies will raise the prices paid by importers. Another effect of the Agreement on Agriculture will be that surplus stocks will decrease as subsidies are reduced, which could limit the volume of food aid. In order to mitigate those effects on least developed and net food-importing developing countries the Ministerial Decision on that issue envisages offsetting measures, such as additional food aid, technical assistance to raise agricultural productivity and short-term assistance to finance commercial food imports.

Table 4. Summary of the main provisions of the Uruguay Round Agreement on Agriculture

Policy	Developed countries	Developing countries
Market access	Prohibition of import restrictions other than tariffs. All tariffs bound. Special safeguard provisions against import surges or persistent import price decline (limited to "tariffied" products and not applicable to imports under related tariff quota commitments). Tariffs resulting from conversion of non-tariff border measures under negotiating modalities plus pre-existing tariffs on all other agricultural products to be reduced. Implementation of current and minimum access opportunity commitments in respect of tariffied products	
	Average tariff reduction of 36 per cent (minimum 15 per cent) over 6 years	Average tariff reduction of 24 per cent (minimum 10 per cent) over 10 years. Least developed countries are not required to undertake reductions
Export subsidies	Export subsidies subject to reduction are defined. Provisions for prevention of circumvention of commitments, including disciplines on the use of export credit and credit guarantees as well as food aid. Prohibition of the use of export subsidies on products not subject to reduction commitments	
	Volume of exports benefiting down by 21 per cent; expenditure on subsidies by 36 per cent; implementation on a product-specific basis; for incorporated/processed products only the expenditure reduction; all over six years	Two thirds of the reduction required for developing countries over 10 years; certain marketing and transport subsidies allowed during implementation period
Export prohibitions and restrictions	Foodstuffs: requirement for advance notice and obligation to consult on, request and provide information	
		Only applicable for net exporters of foodstuff concerned
Domestic support	Two groups: (i) permitted policies (Green Box), such as general services to agriculture, food security stocks, and domestic food aid; (ii) other policies included in the Aggregate Measure of Support (AMS) are subject to reduction commitments. Decoupled direct payments associated with production limiting programmes that are not in Green Box but excluded from AMS	
	De minimis provision allows exclusion from AMS if support is less than 5 per cent of output value. Total AMS support to be reduced by 20 per cent over 6 years	Some policies, such as investment and input subsidies, allowed under certain conditions. De minimis provision allows exclusion from AMS if support is less than 10 per cent of output value. Total AMS support to be reduced by 13.3 per cent over 10 years
Sanitary and phytosanitary measures	Reaffirms the right of countries to set their own health and safety standards provided they are justifiable on scientific grounds and do not result in unjustified or unnecessary barriers to trade. International standards are encouraged	
Other policies	Decision on Measures Concerning the Possible Negative Effects of Reform Programme on Least-Developed and Net Food-Importing Developing Countries	

Source: FAO, Food and International Trade (Rome, 1996).

C. Effect of the Agreement on global production of and trade in food and agricultural products

77. Studies attempting to quantify the impact of the Uruguay Round have yielded varying and not always compatible estimates. The complexity of the reform package, the options for implementation and the uncertainty about the timing of the implementation in some cases make it very difficult to assess the effects. Some studies have therefore concentrated on implementation issues and the interpretation of the Agreement on Agriculture. 7/ The biggest impact of the Uruguay Round is expected to come from the reduction of export subsidies, but even so it is more likely that budget constraints are the real driving force behind the reduction rather than a commitment to liberalizing world trade.

78. Nevertheless, quantitative studies suggest a number of outcomes. First, world prices for agricultural commodities, especially temperate zone products, will increase, although it is unclear by how much. Second, the Agreement will not by itself raise the volume of trade significantly. Third, there will be shifts in production from subsidized production to competitive production, from which developing countries could benefit. Fourth, the gains will initially be concentrated in those countries that have the capacity to respond. Finally, when taking all effects into account, including effects on imports and loss of preferences, the net trade gains in the agricultural sector of some of the economically weaker developing countries are likely to be very small or even negative.

79. The impact of the Uruguay Round on selected agricultural commodities for different regions has been analysed by FAO, using its World Food Model (FAO, 1995). Table 5 presents an overview of the projected impact on prices, production and consumption in the year 2000. Aggregate output for agricultural commodities is projected to grow at 1.6 per cent per annum from 1988 to 2000 in the baseline scenario, and that growth rate remains the same under the Uruguay Round scenario, which is not very surprising since only a small part of production is traded. The overall growth of production is projected to decrease slightly. Decreases in growth rates are greatest for products with high domestic support, such as rice, meat other than bovine, dairy products, coffee and cocoa. By contrast, increases in growth rates are expected for tea and bananas. In absolute terms, the changes in global production levels in the year 2000 due to the Uruguay Round are generally small, exceeding three million tons only in the case of coarse grains.

80. Consumption growth is also expected to slow down a little, especially in the least developed and food deficit countries. Allowing for an average population growth of 1.7 per cent, global per caput consumption is expected to decrease for dairy products, grains, beef and coffee, while per caput consumption of vegetable oils, some meat, tea, bananas, cocoa and rubber should rise.

81. Looking at commodities that account for 60 per cent of the total value of world agricultural trade, the FAO study concludes that the slow-down in growth of trade in agricultural commodities will not be reversed by the Uruguay Round, despite the fact that the effect on growth in trade will be positive, especially for trade in rice, bovine meat, and fats and oils.

Table 5. Projected change in agricultural prices, production and consumption in the year 2000 resulting from the Uruguay Round Agreement on Agriculture

(Thousands of tons)

Commodities	Global			Developing countries		Developed countries	
	Prices a/	Production	Consumption	Production	Consumption	Production	Consumption
Wheat	7	-1 538	-1 781	5 143	-1 578	-6 727	-203
Rice	7	638	013	1 657	662	-974	-49
Coarse grains	5	3 423	1 928	804	-230	2 618	2 158
Fats and oils	4	1 067	1 038	1 010	574	57	464
Oil-meal	--	516	500	565	471	-50	29
Bovine meat	8	164	167	-249	-195	413	362
Pig meat	10	-1 567	-1 484	-739	-590	-828	-894
Ovine meat	10	-36	-36	-25	-46	-11	10
Poultry meat	8	-36	-37	-8	104	-28	-141
Milk	7	371	413	439	-951	-67	1 364
Butter	7	-73	11	-103	28	30	-17
Coffee, cocoa, tea	--	155	186	155	80	0	106
Sugar	--	1 081	1 058	629	739	452	319
Bananas	--	-1 092	-603	-1 034	-145	-58	-458

Source: FAO World Food Model.

Note: A minus sign (-) indicates a deficit or decrease; a dash (--) indicates that the amount is nil or negligible.

a/ Percentage change.

82. Developed country exports of wheat are expected to decrease and imports to increase, which should push wheat prices up by 6 to 7 per cent in the year 2000 due to the Uruguay Round and encourage developing countries to produce more grains for their own requirements. The Uruguay Round is expected to have a significant influence on the rice market because of the reduction of subsidized rice exports by developed countries and the opening of previously closed markets for rice: the volume of global trade is expected to increase by 1.2 million tons and international rice prices to increase by 4 to 7 per cent. Both imports and exports of coarse grains are expected to increase slightly in both developed and developing regions as a result of the Uruguay Round. Although the expected increase in the overall volume of trade is slight, coarse grain prices are expected to rise by between 4 and 7 per cent. In oils, the Uruguay Round is expected to lead to increased import demand in developing countries, particularly in the Far East, including China. That demand will be met largely by the low-cost producing countries of the Far East and Latin America. Oil-meal trade and prices are expected to be little affected. The Uruguay Round is projected to induce a minor rise in the volume of overall meat trade. It should stimulate an increase in imports by countries in the Far East, North America,

Eastern Europe and the countries of the former USSR, as well as Japan, while improved market access should mainly benefit countries in Latin America, North America and Oceania. Partly because of the commitments to reduce subsidized exports, FAO projects a boost in international meat prices on the order of 8 to 10 per cent, although the projected increase is significantly lower in the World Bank/OECD model (3 to 6 per cent). Overall milk trade is not expected to change significantly as a result of the Agreement, although there will be some redistribution of trade flows in terms of regional origin and destination. The reduced volume of subsidized exports permitted to several developed countries will be offset by increased exports from Oceania, while imports into developed countries could rise as a result of the minimum access provisions of the Agreement. An overall boost in milk prices of 7 to 10 per cent is projected.

83. Table 6 details agricultural trade balances, as projected by FAO with and without the Uruguay Round. The effects that can be attributed to the Uruguay Round are rather small. Developed countries can expect to continue to see both import and export growth rates decline relative to the 1980s, albeit at a slightly slower pace. Growth rates of imports and exports of developing countries were on average 2.3 an 2.8 per cent from 1978-1988. For 1988-2000, they were both projected to be on average 1.0 per cent, but the Uruguay Round will increase that to on average 1.7 and 1.6 per cent, respectively. In particular, trade in temperate zone products will be negatively affected, although the developed countries will remain large net exporters of those products.

84. For developing countries, the growth rates of imports and exports from 1977-1987 were on average 5.5 and 4.6, respectively; they were projected for the 1988-2000 period to be on average 3.3 and 2.8, respectively. However, taking the effects of the Uruguay Round into account, projections are for growth rates of 3.9 and 3.4 per cent, respectively.

85. Developing countries' import growth is expected to decline for cereals, the oilseed sector, dairy, some meat and tropical fruit, and to increase for bovine meat and bananas. Exports are expected to expand more rapidly, particularly for rice, coarse grains, dairy, tea, sugar and bananas. The net surplus that developing countries as a group have had in the past is therefore likely to endure.

86. Regional differences also turn out to be small, as indicated in table 6. Africa sees its deficit decrease as an effect of the Uruguay Round, while Latin America and Caribbean, and the Far East see their export surpluses grow, and the developed countries and the Near East see their deficits grow. However, there will be gainers and losers with respect to each commodity.

Table 6. Trade balances of selected agricultural commodities, past and projected

(Billions of United States dollars, free on broad)

	Actual (1987-1989)	Baseline (2000)	Uruguay Round (2000)
World			
Imports	275.5	334.6	362.0
Exports	280.4	340.4	366.2
Developed countries			
Imports	208.7	236.4	256.3
Exports	198.5	223.1	240.0
Developing countries			
Imports	66.8	98.2	105.7
Exports	81.8	114.3	122.6
Africa			
Imports	8.4	13.9	14.9
Exports	9.4	12.4	13.5
Latin America and the Caribbean			
Imports	10.5	15.9	16.8
Exports	30.9	42.3	45.6
Near East			
Imports	17.8	25.5	27.1
Exports	6.5	7.7	8.2
Far East			
Imports	30.1	42.9	46.9
Exports	35.0	51.9	55.3

Source: FAO, Impact of the Uruguay Round on the Agriculture, Commodity and Trade Division (Rome, 1995).

D. Effect on agro-industry and international markets for agricultural and tropical products

87. The main source of growth in agricultural exports of developing countries may come not from their traditional export commodities but increasingly from non-traditional commodities, processed products and expansion into new markets. Those gains from diversification could materialize in several ways. First, geographically - by expanding into new import markets. Second, horizontally - by increasing the number of commodities exported. Thirdly, by vertical expansion - increasing the value added of exports. With respect to vertical diversification, a reduction of tariff escalation as a result of the Uruguay Round may be important.

88. The problem of tariff escalation is that importing countries often put a higher tariff on processed products than on raw materials, which is obviously intended as an incentive to import raw materials rather than processed ones, thus depriving countries that export raw materials of the chance to increase value added on their primary products. To illustrate that problem, tables 7 and 8 provide data on the share of processed agricultural products in total agricultural exports. Table 7 includes primary processing, while table 8 excludes products in that category.

89. As will be noticed, the share of processed products in overall agricultural exports is relatively high for developed countries and low for least developed countries. More importantly, the situation is deteriorating for least developed countries in absolute terms, while the share increases more rapidly for developed than for developing countries, thus widening the gap. When abstracting from primary processing, the differences between developed and developing countries increases. The least developed countries have a low but constant share of processed products.

90. A number of studies have analysed the extent to which tariff escalation on agricultural products has been reduced by the Uruguay Round. One study finds that in most cases the tariff wedge, i.e., the absolute difference in nominal tariffs between the output and the input commodity, will be reduced as a result of the Uruguay Round. That is not surprising, given the minimum decrease of 15 per cent per tariff line. However, for a number of commodity pairs high levels of tariff escalation will still remain or even increase. It should be noted that the change in the size of the wedge may not determine the opportunities for vertical integration in exporting countries. Even though reduced tariffs on processed products may remain prohibitively high, reduced tariffs on raw materials could stimulate exports. The overall effect on shares of processed products in total exports will then be negative, although the reductions would be valued as positive.

Table 7. Share of processed agricultural exports in total agricultural exports

(Percentage)

	1964	1974	1984	1994	Change 1964-1994
Developed	48.8	52.2	55.6	67.3	38.0
Developing	41.7	51.2	46.3	54.1	29.7
Least developed countries	27.0	24.4	18.0	16.9	-37.2

Table 8. Share of advanced processed agricultural exports in total agricultural exports

(Percentage)

	1964	1974	1984	1994	Change 1964-1994
Developed	18.6	20.9	22.4	67.3	74.7
Developing	8.4	9.8	9.8	16.6	97.2
Least developed countries	5.1	5.9	4.6	5.0	-2.4

Preferential trade

91. One of the side-effects of the Uruguay Round will be the erosion of preferential trade margins. The reduction in standard tariff rates, combined with unchanged rates under the various tariff preference schemes, reduces the preference margin. As indicated by a recent study (see table 9), in 1992 the value of agricultural imports under preferential schemes into the United States of America, the European Community and Japan was $15.6 billion, of which 63 per cent pertained to the European Community, 27 per cent to the United States and 10 per cent to Japan. Expressed as a percentage of total agricultural imports, that amounted to 9 per cent for the European Community, 6 per cent for the United States and 2 per cent for Japan. The potential value of preferences granted in 1992 was estimated at US$ 1,853 million, or 12 per cent of the total value of preferential trade. Of that total, 73 per cent was accounted for by the European Community, and about 14 per cent each by the United States and Japan. Africa's share was the highest (36 per cent) followed by South America (23 per cent), Central America and the Caribbean (16 per cent), the Far East (15 per cent), Oceania (5 per cent) and the Near East (3 per cent).

Table 9. Value of preferential margins, by region

(Millions of United States dollars)

Region	Value of preferential trade in 1992	Value of preferential margin in 1992	Value of preferential margin after the Uruguay Round
Africa	4 270	675	509
Far East	3 409	285	105
Near East	1 091	49	23
Central America and the Caribbean	1 997	303	245
South America	4 266	432	246
Oceania	320	90	84
Europe	245	19	8
Total	15 599	1 853	1 221

Source: Yamazaki (1996).

92. The total reduction of potential benefits due to the Uruguay Round is estimated at US$ 634 million, which is equivalent to 34 per cent of pre-Uruguay Round benefits. Table 9 indicates that as a percentage of their pre-Uruguay Round benefits, the Far East loses most (63 per cent), followed by the Near East (51 per cent), South America (43 per cent) and Africa (25 per cent). Those estimates do not take into account the Uruguay Round effects on prices and trade volumes. Nor was growth over the implementation period taken into account, which was estimated to increase the loss by 10 per cent. In addition, the effect of the Uruguay Round on prices and volumes will also decrease the volume of preferential trade, thus further increasing the losses.

E. Effect on global food security

93. Food security can be defined as a situation in which all households have both physical and economic access to adequate food for all members and are not at risk of losing that access. Food security at a national level often implicitly assumes that the domestic distribution of food supports food security. There are two options for achieving food security at the national level: self-sufficiency and self-reliance. Food self-sufficiency means meeting food needs from domestic supplies. Self-reliance takes international trade into account, and implies the capacity to import from the world market as needed; trade is thus an essential part of food security based on self-reliance. But food security based on trade also incorporates risks, related to deteriorating

terms of exchange on world markets, the uncertainty of supplies, price instability and dependence.

94. Global food security is the sum of the food security of individual nations, rather than a sufficient amount of food to feed the world population. Distributional aspects are often far more important than absolute quantities. It is useful to view food security as the combination of three elements: (a) food availability, (b) the reliability of food supplies and (c) access to food for all.

95. The relationship between global food availability and national food security is complex. Under the Uruguay Round Agreement on Agriculture, subsidized production in developing countries above de minimis levels are to be reduced. Also, as already mentioned, the Uruguay Round is not expected to increase the volume of global food production, although there will be shifts in allocation. Some importing developing countries have benefited from cheap food imports generated by pre-reform market conditions. However, for a large number of developing countries, that situation may have had perverse effects. It has led to dependence on imported foodstuffs because many farmers in developing countries could not compete with artificially low world market prices. The situation has been exacerbated by the fact that many developing countries also kept domestic food prices low by taxing agricultural exports directly as well as indirectly by overvalued exchange rates. 8/ Thus, the reduction of world market distortions could induce some developing countries to produce more food for themselves and depend less on imports. It is important, however, that farmers be given the opportunity to respond to the new market opportunities. For that to happen, a change in agricultural policy is often warranted.

96. While the risks with respect to stability of supplies becomes smaller as markets become more competitive, there could be an accompanied increase in price instability. Many developing countries fear that reliance on the world market will increase domestic price instability, with adverse effects on the food security of the poor. Four influences need to be taken into account in assessing the effect of the Uruguay Round on price stability. First, the reduction of tariffs will increase the absorption of production shocks, which is a stabilizing effect. Second, an uncertain effect stems from allocative shifts in production. As production shifts from high-level-of-protection countries to low-level-of-protection countries, it is unclear whether production in the latter countries will become more or less stable as a result. Third, there will be a reduction in the levels of stocks, mainly of major staple foods, which will have a destabilizing effect. Governments have reduced their stocks, and with the reduction in price support programmes will continue to do so. As Governments reduce their stocks, the private sector will not fully replace them. For grains, FAO has estimated that replacement will be well under 50 per cent (FAO, 1990). Fourth, stocks will become more responsive to price signals, the effect of which on price stability is uncertain, because of speculative behaviour. The net overall effect of those four influences on price stability is thus difficult to determine.

97. The relation between price instability and food security should be seen from the perspective of consumers, producers and Governments. Evidently, the poor urban population in developing countries that consists of net food buyers

will be quickly pushed into hunger as a result of price spikes. For all countries that rely on food imports - but particularly the poorest countries - an important aspect of the evaluation of trading regime changes for food security is their likely impact on world market instability. Even if price instability does not increase, the chances of price spikes occurring will probably be greater than in the past because global stocks will be reduced. Instability in income can also lead to less food security. A sudden collapse in the purchasing power of export commodities can thus put a country's food security at risk. For those reasons, countries often maintain a higher level of food self-sufficiency than might otherwise be warranted as insurance against unexpected fluctuations in import purchasing power.

98. The third element of food security is access, which will depend to a large extent on income. There are important differences in expected changes in the trade balance of basic food commodities, in particular how food import bills would be affected by the Uruguay Round in view of projected price increases. As shown in table 10, those increases are expected to be substantial. For the developing countries as a whole, their food import bill is projected to be nearly US$ 25 billion higher in the year 2000 than it was in 1988, an annual increase of about 4 per cent, about US$ 3.6 billion (15 per cent) which will be due to the Uruguay Round. The food import bill of the low-income food-deficit countries is expected to increase by nearly US$ 10 billion, of which 14 per cent, or US$ 1.4 billion, will be due to higher prices as an effect of the Uruguay Round.

99. The ability to pay for higher food import bills depends on the ability to increase export earnings. As can be seen in table 5, the agricultural trade balance of developing countries is projected to improve by some US$ 1.9 billion, of which 0.8 will be due to the Uruguay Round, so that there seem to be in the aggregate some offsetting income gains. However, that improvement in export earnings will not be shared equally among developing countries. Countries that have little capacity to respond to increased opportunities perform less. Among the developing regions, Africa is most problematic: per caput food availability is already low and other sectors are not likely to compensate for the poor export prospects in agriculture. In addition, in regions that are projected to perform better, there are countries, especially among the low-income food-deficit countries, that would face difficulties in paying for their food imports. Country-specific studies are required to assess those problems and decide on compensatory transfers or assistance.

100. In general, developing countries will benefit from the Uruguay Round. Provided domestic policies are in place to spread around the gains and compensate the losers, trade liberalization can contribute to improving food security. The difficulties that developing countries may face during the reform process have been recognized. Those countries were provided with special and differential treatment, mainly in the form of longer periods to adjust. Where countries are confronted with negative effects in terms of the availability of adequate supplies of basic foodstuffs during the reform process, the provisions of the Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least Developed and Net Food-Importing Developing Countries 6/ could provide a safety net.

Table 10. Food bills of developing countries and low-income food-deficit countries, past and projected

(Billions of United States dollars)

	No. of countries	Actual (1987-1988)	Projected (2000)	Size of increase	Of which Uruguay Round effect (percentage)
World					
All developing countries	137	40.0	64.7	24.7	3.6 (15)
LIFD countries	72	17.8	27.6	9.8	1.4 (14)
Africa					
All developing countries	52	6.0	10.5	4.5	0.5 (11)
LIFD countries	43	3.5	6.3	2.8	0.2 (7)
Latin America and the Caribbean					
All developing countries	46	8.0	12.7	4.7	0.3 (6)
LIFD countries	10	1.6	2.4	0.8	0.1 (12)
Near East					
All developing countries	19	11.5	16.8	5.3	0.8 (15)
LIFD countries	6	3.7	4.7	1.0	0.1 (10)
Far East					
All developing countries	20	-4.5	24.7	10.2	2.0 (20)
LIFD countries	13	9.0	14.2	5.2	1.0 (19)

Note. Food comprises cereals, oilseeds and products, meat, and dairy products LIFDs are net cereal importing countries with a per caput income less than the cut-off point defined by the World Bank for IDA eligibility.

Source: J. Greenfield, M. de Nigris and P. Konandreas, "The Uruguay Round Agreement on Agriculture: food security implications for developing countries", Food Policy, vol. 21, No. 4/5 (August 1996).

F. Agricultural policy adjustment

101. Improvements in developing countries' agricultural output and export performance depend on many factors, including improvements in infrastructure (transport systems, energy networks, irrigation etc.); education and training; dissemination of knowledge about appropriate (new) production technologies and product varieties; pest and disease control systems; quality management; and reforms of the domestic regulatory system, including the agricultural price system, the distribution system and land reform. Better market access abroad and better trade and trade-related policies at home are also important: they can help to raise agricultural (and other sectors') productivity, income and employment, and at least indirectly help to overcome the wider impediments to economic development and food security in developing countries, including by making those countries more attractive for, and increasing the efficiency of, foreign direct investment (through the transfer of capital, skills, technology and marketing channels), official aid and technical assistance.

102. While direct subsidization of production will be increasingly limited and the use of quantitative restraints on imports is prohibited, there are no restraints on the use of public investment measures for agricultural and rural development purposes. Investment and input subsidies, both frequently used measures in developing countries to promote increased production, continue to be permitted to developing countries under the Uruguay Round Agreement.

103. In many developing countries, reforms undertaken within the framework of structural adjustment programmes go well beyond the adjustments countries are required to make under the Uruguay Round. Structural adjustment programmes usually require greater reductions in border protection than are required under the Uruguay Round. Input subsidies and consumer food subsidy programmes, permitted under the Uruguay Round, must often be cut back under structural adjustment programmes, which usually require currency devaluation and institutional reforms as well, areas not covered by the Uruguay Round.

104. The indirect effects on agricultural production incentives of industrial sector protection, exchange-rate overvaluation, government procurement and export taxation are often more important than the direct effects of sectoral policies, such as input subsidies. One study (Krueger, Schiff and Valdés, 1988) shows that in many developing countries those indirect effects dominate direct policy effects. Generally, however, the Uruguay Round underpins the reforms undertaken by developing countries, and provides some assurance of increased market access in return for the risks that they have taken or will take in opening up their markets to trade.

105. Under the Uruguay Round Agreement, there are significant possibilities for consumption support policies and policies to reduce the impact of world market fluctuations. Domestic food aid, for example, is included under the Green Box measures, and direct price support is still feasible under the de minimis provision. To reduce the effect of market instability, there are the special safeguard conditions, the sliding scale of tariffs option, the allowed food security stocks and the allowed export limitations. However, budgetary constraints are likely to limit those policy options.

106. Although the Uruguay Round does not itself address that budgetary problem shared by many developing countries, it does contain a commitment not to aggravate it in the Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least Developed and Net Food-Importing Developing Countries. The promise is that if food import prices rise because of the Uruguay Round, net food-importing developing countries and the least developed countries could be eligible for increased food aid, financial support to maintain normal food imports, technical support to raise agricultural productivity, and eventually favourable treatment on agricultural export credits. Such aid could help those countries to mitigate the effect on consumer price increases, while allowing producer prices to rise.

107. The interpretation of the Decision raises a number of questions related to its implementation. It is not clear how food is defined. In addition, the basis (trigger) for compensation is not clear. It is also not clear how the effect of the Uruguay Round can be determined. Most importantly, however, is the question of the mechanisms (bilateral, multilateral) for, and automaticity of, compensation.

108. Food aid is the most direct option. In principle, the Uruguay Round will reduce the existence of surpluses in donor countries to which food aid has been closely linked. However, as Hathaway and Ingco (1995) argue, since the agreement puts specific limits on the use of export subsidies, food aid will remain the only legitimate method of moving excess supplies into the world. Thus, if donor countries continue to use output expanding subsidies in the face of limits on export subsidies, the Agreement may encourage rather than limit food aid.

109. A more structural solution means of support would be to increase agricultural productivity and strengthen infrastructure. If price increases are passed on to producers and supply can be made more elastic by technical support and improvement of infrastructure, then import needs will be reduced. Financial support by means of cheap loans, such as those offered by the IMF facility for cereals, or a grant raises a lot of considerations to make sure that the finance is used for food imports.

110. The Uruguay Round has many implications for national and international agricultural policy, some of which the World Food Summit will undoubtedly address. Re-examination of agricultural policies are required in the following areas: (a) higher food prices may call for changes in national food security and nutrition enhancement policies, including consumer price policies for food; (b) despite better incentives to producers, most developing countries will need to evolve targeted and decoupled (Green Box) forms of assistance; (c) tariffication, and thus elimination of non-tariff barriers, may lead to greater domestic price instability, which may in turn lead to reconsideration of producer price policies and measures to prevent excessive instability; (d) some countries have to increase domestic food production and productivity to enhance food security in harmony with their comparative advantages; (e) increased transparency after the elimination of non-tariff barriers may lead to increased intraregional or subregional trade agreements; (f) export promotion policies may be considered to benefit from new market opportunities; (g) further promotion of diversification and primary processing is called for, which requires avoidance

of tariff escalation and targeted tariff reduction in areas of potential growth. In addition, technical assistance will often be required.

G. Conclusion

111. Food trade is vital to world food security. Without trade, countries would have to rely exclusively on their own production. International trade influences food security in several ways. In the first place, trade allows food consumption to exceed food production in countries in which output is constrained. Resorting to imports generally allows food consumption needs to be met more cheaply than by relying on domestic production alone. While there can be specific reasons for some countries to aim at substantial food self-sufficiency, in general it makes better economic sense to follow a more flexible policy of food self-reliance, provided importers can rely on the world market as a dependable and efficient source of supply and exporters have a good market for their products. Particular concerns for importing countries are whether imports will be available when needed and the possible risk of trade embargoes.

112. Trade liberalization as reflected in the Uruguay Round of multilateral trade negotiations is not likely to affect significantly the global availability of food because reduced output in high-cost countries will be generally replaced by increased output in other countries. In view of the likely change in the medium term in favour of food commodities' relative prices, countries may wish to revise their agricultural policies and consider passing on some of the increase in world prices to their domestic sectors so as to stimulate food production. The effect of trade liberalization on the stability of world food prices is uncertain. The impact of trade on household food security is part of a wider issue concerning the impact of economic growth and transformation on welfare and its distribution. Trade provides opportunities for specialization and growth, but the extent to which poor households can take advantage of such opportunities depends on their access to resources and jobs, which depends in turn on the institutional environment and the supportive role of the State.

113. Provided domestic policies are in place to spread around the gains and/or to compensate the losers, then trade liberalization can play an important role in improving food security even though there may be problems of adjustment to the new trade regime. The difficulties that countries may face during the reform process have been recognized and developing countries have been given special and differential treatment, mainly in the form of granting them longer periods to make adjustments and lower reduction commitments. The Uruguay Round accords also recognize that during the process of reform, the least developed and net food-importing countries may experience negative effects in terms of the availability of adequate imported supplies of basic foodstuffs on reasonable terms and conditions. Accordingly, great importance is attached to making sure that the Uruguay Round Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least-Developed and Net Food-Importing Developing Countries is implemented rapidly. The Uruguay Round may not make much difference to the volume of food aid, because, while the amount linked to surplus disposal may decline, the quantities linked to assistance under the above-mentioned Decision may well be increased. The Uruguay Round has many

implications for national and international agricultural policy, which need to be studied further to identify appropriate policy responses at both levels.

Notes

1/ Oxford University Press for Habitat, 1996.

2/ At its second session, in 1994, the Commission on Sustainable Development urged relevant United Nations bodies to strengthen their efforts to produce a comprehensive assessment of freshwater resources. Participating United Nations bodies include the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, FAO, UNEP, UNESCO, UNDP, UNIDO, WHO and the World Bank. The activity is coordinated jointly by the ACC Subcommittee on Water Resources and the Stockholm Environment Institute of the Government of Sweden; it is currently ongoing and the resulting report will be presented to Governments at the fifth session of the Commission and at the fifty-second session of the General Assembly, in 1997.

3/ Among a number of technical background papers prepared for the Summit, FAO has prepared one entitled "Food production: the critical role of water".

4/ Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

5/ Washington, D.C., World Bank, 1993.

6/ See The Results of the Uruguay Round of Multilateral Trade Negotiations: The Legal Texts (Geneva, GATT secretariat, 1994).

7/ D. E. Hathaway and M. D. Inglo, "Agricultural liberalization and the Uruguay Round", in World Bnak, "The Uruguay Round and the developing countries", W. Martin and L. A. Winters, eds., World Bank Discussion Paper, No. 307 (Washington, D.C., 1995).

8/ A. Krueger, M. Schiff and A. Valdés, "Agricultural incentives in developing countries: measuring the effect of sectoral and economy-wide policies", World Bank Economic Review, vol. 2, No. 3 (September 1988).

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